APPENDIX A

PROBLEM/OBJECTIVE DEFINITION

DELTA LEVEE SYSTEM INTEGRITY PROGRAM

CALFED
Bay-Delta Program

DRAFT
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PROBLEM AND OBJECTIVE STATEMENTS
FOR
DELTA LEVEE SYSTEM INTEGRITY

The CALFED Bay-Delta Program will develop a long-term comprehensive plan to solve problems in the Bay-Delta system related to four resource areas: ecosystem quality, water supply reliability, water quality, and Delta levee system integrity. Problems and program objectives related to Delta levee system integrity are listed below.

Problem

Levees were first constructed in the Sacramento-San Joaquin Delta during the mid-to-late 1800s, when settlers began to turn tidal marshes into agricultural land. Over time, both natural settling of the levees and shallow subsidence of Delta island soils (oxidation which lowers the level of the land over time) resulted in a need to increase levee heights to maintain protection. There is a growing concern that this increased height, coupled with poor levee construction and inadequate maintenance, makes Delta levees vulnerable to failure, especially during earthquakes or floods.

Failure of Delta levees can result in flooding of Delta island farmland and wildlife habitat. If a flooded island is not repaired and drained, the resulting large body of open water can expose adjacent islands to increased wave action and possible levee erosion. Inundation of one or more islands in the Delta would disrupt farming operations and other land uses either permanently or for a significant period of time until repairs can be made. Inundation of roads, electric power lines, telephone lines, gas mains, and other infrastructure would cause lengthy breaks in service. Several state highways and many Delta roads run along levees that are vulnerable to collapse due to erosion, seismic events or structural failure.

Levee failure on specific islands can have impacts on water supply distribution systems such as the Mokelumne Aqueduct. Even if they survive the initial effects of inundation, long-term inundation would make continued maintenance and repair much more difficult. Similarly, levee failure on key Delta islands can draw salty water up into the Delta, as water from downstream rushes to fill the breached island. This would be of particular concern in a low water year when less freshwater would be available to repel the incoming salt water. This salinity intrusion would degrade water quality and result in a need to halt in-Delta use as well as export pumping, perhaps for extended periods. In order to lower salinity in the Delta to acceptable levels again, flushing flows would need to be released from upstream reservoirs. Stored water supplies in these reservoirs could be seriously depleted. Long-term flooding of key Delta islands can also have an effect on water quality by changing the location and volume of the mixing zone.

Failure of Delta levees can result from earthquakes and floods, or from gradual deterioration. The subsidence of the Delta island peat soils and settling of levee foundations places additional pressure on levees and increases the risk of failure.

Local reclamation districts are concerned with the cost of maintaining and improving the levee and channel system. The complex array of agencies with planning, regulatory, and/or permitting authorities over levees makes rehabilitation and maintenance efforts difficult. Regulatory measures which protect endangered species or critical habitat sometimes conflict with and prolong levee rehabilitation and maintenance work, which can further increase the vulnerability of the system.

Delta Levee System Integrity -- Problem Statements

Many of the "problems" commonly listed for the vulnerability of Bay-Delta system functions are actually causes of problems. For example, poor levee construction, inadequate maintenance, the lowering of the islands due to subsidence, levee instability, and lack of resistance to earthquake and floods are causes of the problems tied to levee failure. There are four major problems for the vulnerability of Bay-Delta system functions due to potential failure of Delta levees and inundation of islands: loss of land use, infrastructure and associated economies; damage to wildlife habitat, interruption of water supply, and reduction in Delta water quality. The problems can be categorized as follows:

A. **Existing agricultural land use, economic activities, and infrastructure** in the Delta are at risk from gradual deterioration of Delta conveyance and flood control facilities as well as sudden catastrophic inundation of Delta islands.

   1. **Reduction of agricultural productivity and damage to infrastructure** can result from seepage and overtopping of the levees.

   2. **Long-term loss of agricultural productivity and infrastructure** can result from catastrophic island inundation.

B. **Water supply facilities and operations** in the Delta are at risk from increased salinity intrusion, which can result from sudden catastrophic inundation of Delta islands.

   1. **In-Delta water supply** can be interrupted as a result of catastrophic island inundation and resultant salinity intrusion. (See Water Supply Problem Statement.)

2. **Export water supply** can be interrupted as a result of catastrophic island inundation and resultant salinity intrusion. (See Water Supply Problem Statement.)

C. **Water quality** in the Delta is at risk from increased salinity intrusion which can result from sudden catastrophic inundation of Delta islands.

1. Water quality for some **in-Delta beneficial uses** can be degraded as a result of catastrophic island inundation and resultant salinity intrusion. (See Water Quality Problem Statement).

2. Water quality for **export water supply** can be degraded as a result of catastrophic island inundation and resultant salinity intrusion. (See Water Quality Problem Statement.)

D. The existing **Delta ecosystem** is at risk from gradual deterioration of Delta conveyance and flood control facilities as well as catastrophic inundation of Delta islands.

1. **Reduction of ecosystem productivity** and damage to valuable habitat can result from seepage, erosion, and overtopping of levees.

2. **Long-term loss of valuable aquatic and terrestrial habitat** can result from catastrophic island inundation and resultant salinity intrusion.

Objective

The primary program objective for addressing Bay-Delta levee system integrity is to reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees. The vulnerability of the levee system to both general failure and sudden catastrophic failure can be reduced by implementing an integrated and comprehensive program for Delta levees and channels. This plan would need to streamline and consolidate the planning, regulatory, and permitting processes which affect the system, and provide a reliable funding source for system maintenance and rehabilitation.

Delta Levee System Integrity – Objective Statements

A. **Manage the risk to existing land use, associated economic activities, and infrastructure** from gradual deterioration of Delta conveyance and flood control facilities and catastrophic inundation of Delta islands.

1. **Manage the risk of reduction of agricultural productivity and damage to infrastructure** from seepage and overtopping of the levees. **Manage subsidence** of the Delta island peat soils and foundations which places additional pressure on surrounding levees and increases the risk of failure.

2. **Manage the risk of long-term loss of agricultural productivity and infrastructure** which can result from sudden catastrophic inundation.

B. **Manage the risk to water supply facilities and operations** in the Delta from catastrophic inundation of Delta islands.

1. **Manage the risk of interruption of in-Delta water supply** which can result from sudden catastrophic island inundation and the resultant salinity intrusion. (See Water Supply Objective Statement.)

2. **Manage the risk of interruption of export water supply** which can result from sudden catastrophic island inundation and the resultant salinity intrusion. (See Water Supply Objective Statement.)

C. **Manage the risk to water quality** in the Delta from catastrophic inundation of Delta islands.

1. **Manage the risk of degradation of in-Delta water quality** which can result from sudden catastrophic island inundation and the resultant salinity intrusion. (See Water Quality Objective Statement.)

2. **Manage the risk of degradation of export water supply** which can result from sudden catastrophic island inundation and the resultant salinity intrusion. (See Water Quality Objective Statement).

D. **Manage the risk to existing Delta ecosystem** from gradual deterioration of Delta conveyance and flood control facilities and catastrophic inundation of Delta islands.

1. **Manage the risk of reduction of ecosystem productivity and damage to valuable habitat** which can result from seepage, erosion, and overtopping of levees. **Manage subsidence** of the Delta island peat soils and foundations providing this ecosystem productivity which places additional pressure on surrounding levees and increases the risk of failure.

2. **Manage the risk of long-term loss of valuable aquatic and terrestrial habitat** which can result from sudden catastrophic inundation and the resultant salinity intrusion.

Linkages

An important aspect of reducing risk and making the system less vulnerable to failure will be to reduce the conflict between protection of wildlife habitat that occurs on levees, and maintenance of these levees to prevent failure. Riparian woodland, shaded riverine, aquatic, and shallow water habitats are very important for fish and wildlife in the Delta, including threatened and endangered species. In many cases, objectives of reducing risk of catastrophic failure and protection of ecosystem quality can be achieved by incorporating habitat restoration and protection elements in levee system stabilization actions. Conversely, projects to restore or enhance habitat can achieve multiple objectives if they are planned with levee vulnerability in mind. A second critical linkage can occur between efforts to reduce or reverse subsidence and efforts to restore habitat. Both the Delta ecosystem (including the aquatic habitat and the terrestrial habitat found on the levees and inside the islands) and system stability can benefit from reducing land surface subsidence adjacent to the levees. This achievement of multiple objectives can occur where levee stabilization is proposed and where habitat enhancement (riverine and riparian) is proposed. For example, one method to reduce subsidence, the creation of shallow wetlands adjacent to the land side toe of the levee, also serves to enhance habitat.